RIGOL

Quick Guide

MSO2000A/DS2000A Series
Digital Oscilloscope

Nov. 2013

RIGOL Technologies, Inc.

Guaranty and Declaration

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RIGOL guarantees this product conforms to the national and industrial standards in China as well as the ISO9001:2008 standard and the ISO14001:2004 standard. Other international standard conformance certification is in progress.

Contact Us

If you have any problem or requirement when using our products or this manual, please contact **RIGOL**.

E-mail: service@rigol.com

Website: www.rigol.com

Safety Requirement

General Safety Summary

Please review the following safety precautions carefully before putting the instrument into operation so as to avoid any personal injury or damage to the instrument and any product connected to it. To prevent potential hazards, please use the instrument only specified by this manual.

Use Proper Power Cord.

Only the power cord designed for the instrument and authorized for use within the local country could be used.

Ground The Instrument.

The instrument is grounded through the Protective Earth lead of the power cord. To avoid electric shock, it is essential to connect the earth terminal of power cord to the Protective Earth terminal before any inputs or outputs.

Connect the Probe Correctly.

If a probe is used, do not connect the ground lead to high voltage since it has the isobaric electric potential as ground.

Observe All Terminal Ratings.

To avoid fire or shock hazard, observe all ratings and markers on the instrument and check your manual for more information about ratings before connecting.

Use Proper Overvoltage Protection.

Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might expose to danger of electrical shock.

Do Not Operate Without Covers.

Do not operate the instrument with covers or panels removed.

Do Not Insert Anything into the Holes of Fan.

Do not insert anything into the holes of the fan to avoid damaging the instrument.

Use Proper Fuse.

Please use the specified fuses.

Avoid Circuit or Wire Exposure.

Do not touch exposed junctions and components when the unit is powered.

Do Not Operate With Suspected Failures.

If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations. Any maintenance, adjustment or replacement especially to circuits or

accessories must be performed by **RIGOL** authorized personnel.

Keep Well Ventilation.

Inadequate ventilation may cause increasing of temperature or damages to the device. So please keep well ventilated and inspect the intake and fan regularly.

Do Not Operate in Wet Conditions.

In order to avoid short circuiting to the interior of the device or electric shock, please do not operate in a humid environment.

Do Not Operate in an Explosive Atmosphere.

In order to avoid damages to the device or personal injuries, it is important to operate the device away from an explosive atmosphere.

Keep Product Surfaces Clean and Dry.

To avoid the influence of dust and/or moisture in air, please keep the surface of device clean and dry.

Electrostatic Prevention.

Operate in an electrostatic discharge protective area environment to avoid damages induced by static discharges. Always ground both the internal and external conductors of the cable to release static before connecting.

Proper Use of Battery.

If a battery is supplied, it must not be exposed to high temperature or in contact with fire. Keep it out of the reach of children. Improper change of battery (**note:** lithium battery) may cause explosion. Use **RIGOL** specified battery only.

Handling Safety.

Please handle with care during transportation to avoid damages to buttons, knob interfaces and other parts on the panels.

Safety Terms and Symbols

Terms Used in this Manual. These terms may appear in this manual:

WARNING

Warning statements indicate the conditions or practices that could result in injury or loss of life.

CAUTION

Caution statements indicate the conditions or practices that could result in damage to this product or other property.

Terms Used on the Product. These terms may appear on the product:

DANGER	indicates an injury or hazard may immediately happen.
WARNING	indicates an injury or hazard may be accessible potentially.
CAUTION	indicates potential damage to the instrument or other property might occur.

Symbols Used on the Product. These symbols may appear on the product:

Hazardous Voltage

Safety Warning

Protective Earth Terminal

Chassis Ground

Test Ground

Allgemeine Sicherheits Informationen

Überprüfen Sie diefolgenden Sicherheitshinweise sorgfältigumPersonenschädenoderSchäden am Gerätundan damit verbundenen weiteren Gerätenzu vermeiden.Zur Vermeidung vonGefahren, nutzen Sie bitte das Gerät nur so, wiein diesem Handbuchangegeben.

Um Feuer oder Verletzungen zu vermeiden, verwenden Sie ein ordnungsgemäßes Netzkabel.

Verwenden Sie für dieses Gerät nur das für ihr Land zugelassene und genehmigte Netzkabel.

Erden des Gerätes.

Das Gerät ist durch den Schutzleiter im Netzkabel geerdet. Um Gefahren durch elektrischen Schlag zu vermeiden, ist es unerlässlich, die Erdung durchzuführen. Erst dann dürfen weitere Ein- oder Ausgänge verbunden werden.

Anschluss einesTastkopfes.

Die Erdungsklemmen der Sonden sindauf dem gleichen Spannungspegel des Instruments geerdet. SchließenSie die Erdungsklemmen an keine hohe Spannung an.

Beachten Sie alle Anschlüsse.

Zur Vermeidung von Feuer oder Stromschlag, beachten Sie alle Bemerkungen und Markierungen auf dem Instrument. Befolgen Sie die Bedienungsanleitung für weitere Informationen, bevor Sie weitere Anschlüsse an das Instrument legen.

Verwenden Sie einen geeigneten Überspannungsschutz.

Stellen Sie sicher, daß keinerlei Überspannung (wie z.B. durch Gewitter verursacht) das Gerät erreichen kann. Andernfallsbestehtfür den Anwender die GefahreinesStromschlages.

Nicht ohne Abdeckung einschalten.

Betreiben Sie das Gerät nicht mit entfernten Gehäuse-Abdeckungen.

Betreiben Sie das Gerät nicht geöffnet.

Der Betrieb mit offenen oder entfernten Gehäuseteilen ist nicht zulässig. Nichts in entsprechende Öffnungen stecken (Lüfter z.B.)

Passende Sicherung verwenden.

Setzen Sie nur die spezifikationsgemäßen Sicherungen ein.

Vermeiden Sie ungeschützte Verbindungen.

Berühren Sie keine unisolierten Verbindungen oder Baugruppen, während das Gerät in Betrieb ist.

Betreiben Sie das Gerät nicht im Fehlerfall.

Wenn Sie am Gerät einen Defekt vermuten, sorgen Sie dafür, bevor Sie das Gerät wieder betreiben, dass eine Untersuchung durch qualifiziertes Kundendienstpersonal durchgeführt wird.Jedwede Wartung, Einstellarbeiten oder Austausch von Teilen am Gerät, sowie am Zubehör dürfen nur von

RIGOL autorisiertem Personal durchgeführt werden.

Belüftung sicherstellen.

Unzureichende Belüftung kann zu Temperaturanstiegen und somit zu thermischen Schäden am Gerät führen. Stellen Sie deswegen die Belüftung sicher und kontrollieren regelmäßig Lüfter und Belüftungsöffnungen.

Nicht in feuchter Umgebung betreiben.

Zur Vermeidung von Kurzschluß im Geräteinneren und Stromschlag betreiben Sie das Gerät bitte niemals in feuchter Umgebung.

Nicht in explosiver Atmosphäre betreiben.

Zur Vermeidung von Personen- und Sachschäden ist es unumgänglich, das Gerät ausschließlich fernab jedweder explosiven Atmosphäre zu betreiben.

Geräteoberflächen sauber und trocken halten.

Um den Einfluß von Staub und Feuchtigkeit aus der Luft auszuschließen, halten Sie bitte die Geräteoberflächen sauber und trocken.

Schutz gegen elektrostatische Entladung (ESD).

Sorgen Sie für eine elektrostatisch geschützte Umgebung, um somit Schäden und Funktionsstörungen durch ESD zu vermeiden. Erden Sie vor dem Anschluß immer Innen- und Außenleiter der Verbindungsleitung, um statische Aufladung zu entladen.

Die richtige Verwendung desAkku.

Wenneine Batterieverwendet wird, vermeiden Sie hohe Temperaturen bzw. Feuer ausgesetzt werden.Bewahren Sie es außerhalbder Reichweitevon Kindern auf.UnsachgemäßeÄnderung derBatterie(Anmerkung:Lithium-Batterie)kann zu einer Explosion führen. VerwendenSie nur von RIGOLangegebenenAkkus.

Sicherer Transport.

Transportieren Sie das Gerät sorgfältig (Verpackung!), um Schäden an Bedienelementen, Anschlüssen und anderen Teilen zu vermeiden.

Sicherheits Begriffe und Symbole

Begriffe in diesem Guide. Diese Begriffe können in diesem Handbuch auftauchen:

WARNING

Die Kennzeichnung WARNING beschreibt Gefahrenquellen die leibliche Schäden oder den Tod von Personen zur Folge haben können.

CAUTION

Die Kennzeichnung Caution (Vorsicht) beschreibt Gefahrenquellen die Schäden am Gerät hervorrufen können.

Begriffe auf dem Produkt. Diese Bedingungen können auf dem Produkt erscheinen:

DANGER	weist auf eine Verletzung oder Gefährdung hin, die sofort geschehen kann.
WARNING	weist auf eine Verletzung oder Gefährdung hin, die möglicherweise nicht sofort geschehen.
CAUTION	bedeutet, dass eine mögliche Beschädigung des Instruments oder anderer Gegenstände auftreten kann.

Symbole auf dem Produkt. Diese Symbole können auf dem Produkt erscheinen:

Gefährliche Spannung

Sicherheits-Hinweis

Schutz-erde

Gehäuse-masse

Erde

Measurement Category

Measurement Category

MSO2000A/DS2000A series digital oscilloscopes can make measurements in Measurement Category I.

WARNING

This oscilloscope can only be used for measurements within its specified measurement categories.

Measurement Category Definitions

Measurement category I is for measurements performed on circuits not directly connected to MAINS. Examples are measurements on circuits not derived from MAINS, and specially protected (internal) MAINS derived circuits. In the latter case, transient stresses are variable; for that reason, the transient withstand capability of the equipment is made known to the user.

Measurement category II is for measurements performed on circuits directly connected to the low voltage installation. Examples are measurements on household appliances, portable tools and similar equipment.

Measurement category III is for measurements performed in the building installation. Examples are measurements on distribution boards, circuit-breakers, wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and equipment for industrial use and some other equipment, for example. Stationary motors with permanent connection to the fixed installation.

Measurement category IV is for measurements performed at the source of the low-voltage installation. Examples are electricity meters and measurements on primary overcurrent protection devices and ripple control units.

Ventilation Requirement

This oscilloscope uses fan to force cooling. Please make sure that the air intake and exhaust areas are free from obstructions and have free air. When using the oscilloscope in a bench-top or rack setting, provide at least 10 cm clearance beside, above and behind the instrument for adequate ventilation.

WARNING

Inadequate ventilation may cause temperature increase which would damage the instrument. So please keep the instrument well ventilated during operation and inspect the intake and fan regularly.

Working Environment

Temperature

Operating: 0℃ to +50℃

Non-operating: -40℃ to +70℃

Humidity

0℃ to +30℃: ≤95% relative humidity

+30℃ to +40℃: ≤75% relative humidity

+40℃ to +50℃: ≤45% relative humility

WARNING

To avoid short circuit inside the instrument or electric shock, please do not operate in humid environment.

Altitude

Operating: less than 3 km

Non-operating: less than 15 km

Installation (overvoltage) Category

This product is powered by mains conforming to installation (overvoltage) category II.

WARNING

Make sure that no overvoltage (such as that caused by thunderbolt) can reach the product, or else the operator might expose to danger of electric shock.

Installation (overvoltage) Category Definitions

Installation (overvoltage) category I refers to signal level which is applicable to equipment measurement terminals connected to the source circuit. In these terminals, precautions are done to limit the transient voltage to the corresponding low level.

Installation (overvoltage) category II refers to the local power distribution level which is applicable to equipment connected to the AC line (AC power).

Pollution Degree

Degree 2

Pollution Degree Definitions

Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. For example: a clean room or air-conditioned office environment.

Pollution degree 2: Normally only dry, non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur. For example: general indoor environment.

Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. For example: Sheltered outdoor environment.

Pollution degree 4: Pollution that generates persistent conductivity through conductive dust, rain, or snow. For example: outdoor locations.

Safety Class

Class 1 – Grounded Product

General Care and Cleaning

General Care:

Do not store or leave the instrument in where the instrument will be exposed to direct sunlight for long periods of time.

Cleaning:

Clean the instrument regularly according to its operating conditions. To clean the exterior surface, perform the following steps:

1. Disconnect the instrument from all power sources.
2. Clean the loose dust on the outside of the instrument with a lint- free cloth (with a mild detergent or water). When cleaning the LCD, take care to avoid scarifying it.

CAUTION

To avoid damages to the instrument, do not expose them to liquids which have causticity.

WARNING

To avoid injury resulting from short circuit, make sure the instrument is completely dry before reconnecting to a power source.

Environmental Considerations

The following symbol indicates that this product complies with the WEEE Directive 2002/96/EC.

Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health. In order to avoid release of such substances into the environment and harm to human health, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately. Please contact your local authorities for disposal or recycling information.

Document Overview

This manual is used to guide users to quickly get familiar with the front panel, rear panel, user interface and basic operation method of MSO2000A/DS2000A series digital oscilloscope. You can download the newest version of the manual from www.rigol.com.

Format Conventions in this Manual:

1. **Button**

   The front panel keys are denoted by the format of "Button Name (Bold) + Text Box". For example, **Utility** denotes the "Utility" key.

2. **Menu**

   The menu softkeys are denoted by the format of "Menu Word (Bold) + Character Shading". For example, **System** denotes the "System" menu under **Utility**.

3. **Operation Step**

   The next step of operation is denoted by an arrow "→". For example, **Utility** → **System** denotes pressing **Utility** and then pressing **System**.

4. **Knob**

Logo	Knob	Logo	Knob
HORIZONTAL SCALE	Horizontal Scale Knob	**VERTICAL SCALE**	Vertical Scale Knob
HORIZONTAL POSITION	Horizontal Position Knob	**VERTICAL POSITION**	Vertical Position Knob
TRIGGER LEVEL	Trigger Level Knob	--	--

Content Conventions in this Manual:

MSO2000A/DS2000A series includes the following models. In this manual, MSO2302A-S is taken as an example to illustrate the functions and operation methods of MSO2000A/DS2000A series.

Model	Analog Bandwidth	Channels	Source Channels
MSO2072A/DS2072A	70 MHz	2	--
MSO2072A-S/DS2072A-S	70 MHz	2	2
MSO2102A/DS2102A	100 MHz	2	--
MSO2102A-S/DS2102A-S	100 MHz	2	2
MSO2202A/DS2202A	200 MHz	2	--
MSO2202A-S/DS2202A-S	200 MHz	2	2
MSO2302A/DS2302A	300 MHz	2	--
MSO2302A-S/DS2302A-S	300 MHz	2	2

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Quick Start

General Inspection

1. **Inspect the shipping container for damage.**
   Keep the damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has passed both electrical and mechanical tests.

   The consigner or carrier shall be liable for the damage to instrument resulting from shipment. **RIGOL** would not be responsible for free maintenance/rework or replacement of the unit.

2. **Inspect the instrument.**
   In case of any damage, or defect, or failure, notify your **RIGOL** sales representative.

3. **Check the Accessories**
   Please check the accessories according to the packing lists. If the accessories are incomplete or damaged, please contact your **RIGOL** sales representative.

Appearance and Dimensions

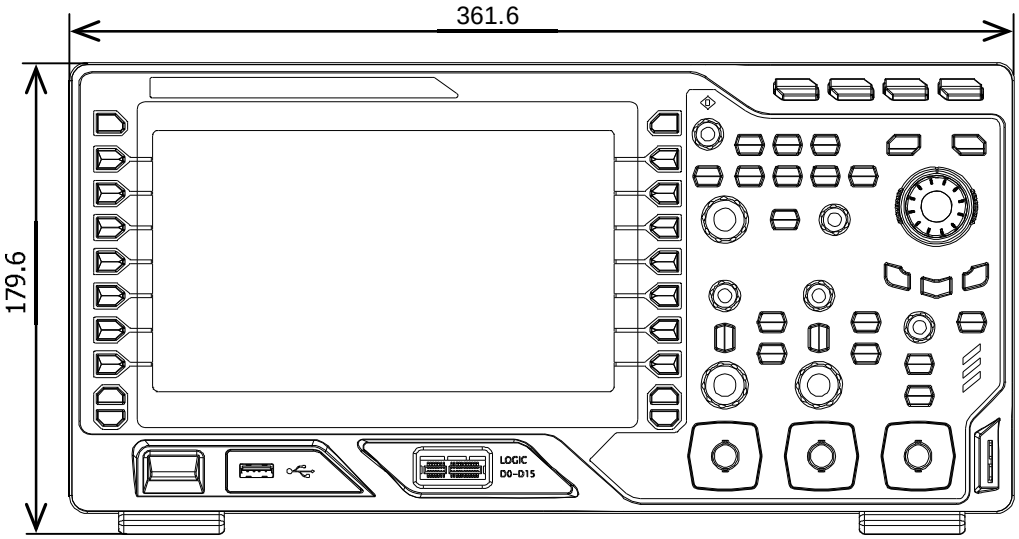


Figure 1 Front View Unit: mm

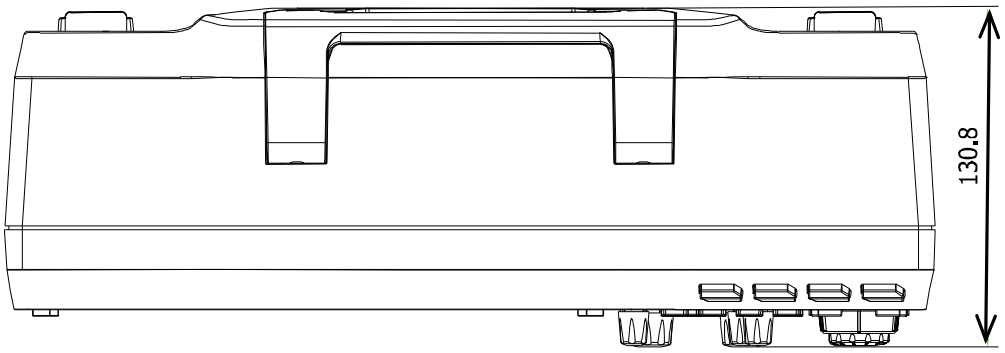


Figure 2 Top View Unit: mm

To Prepare for Operation

To Adjust the Supporting Legs

Adjust the supporting legs properly to use them as stands to tilt the oscilloscope upwards for stable placement of the instrument as well as easier operation and observation of the instrument.

Figure 3 To Adjust the Supporting Legs

To Connect to AC Power Supply

This oscilloscope can accept 100-240 V, 45-440 Hz AC power supply. Please use the power cord supplied with the accessories to connect the oscilloscope to the power supply as shown in the figure below. At this point, the oscilloscope is energized and the power key at the lower-left corner of the front panel is in breathing state.

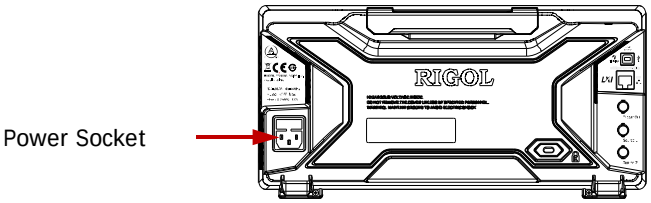


Figure 4 To Connect to AC Power Supply

Power-on Inspection

When the oscilloscope is energized, press the power key at the lower-left corner of the front panel to turn on the oscilloscope. During the start-up process, the oscilloscope performs a series of self-test items and you can hear the sound of relay switching. After the self-test is finished, the welcome screen is displayed. The instrument is installed with the trial versions of the options before leaving factory and the remaining time is about 2000 minutes. The "Current Options" dialog box will be displayed if your instrument currently installs the trial versions of options. From this dialog box you can view the types, names, versions and the remaining time of the options currently installed.

To Connect the Probe

RIGOL provides passive probes for DS2000A as well as passive probes and logic probes for MSO2000A. For detailed technical information of the probes, please refer to corresponding Probe User's Guide. The following are the probes recommended for use with the oscilloscope.

Model	Description
RP3300A	300 MHz, passive probe, standard
RP3500A	500 MHz, passive probe, optional
RPL2316	Logic probe, standard

Connect the Passive Probe:

1. Connect the BNC terminal of the probe to an analog channel input of the oscilloscope at the front panel.
2. Connect the ground alligator clip of the probe to the circuit ground terminal and then connect the probe tip to the circuit point under test.

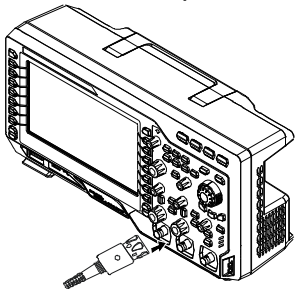


Figure 5 To Connect the Passive Probe

Connect the Logic Probe:

1. Connect the single-wire terminal of the logic probe to the **[LOGIC D0-D15]** digital channel interface at the front panel of MSO2000A in the correct direction.
2. Connect the other terminal of the logic probe to the signal under test. MSO2000A is provided with the RPL2316 logic probe which provides three connecting methods to connect to the signal under test to fulfill the requirements of different application environment. For the details, please refer to the *RPL2316 Logic Probe User's Guide*.

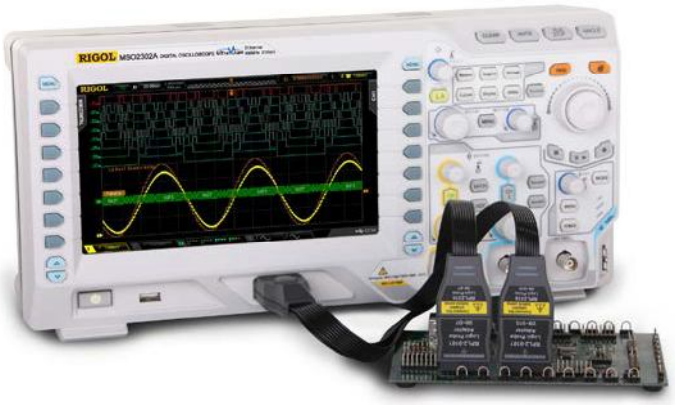


Figure 6 To Connect the Logic Probe

Function Inspection

1. Press **Storage** → **Default** to restore the oscilloscope to its default configuration.
2. Connect the earth alligator clip of the probe to the “Ground Terminal” as shown in the figure below.
3. Use the probe to connect the input terminal of CH1 and the “Compensation Signal Output Terminal” of the oscilloscope.

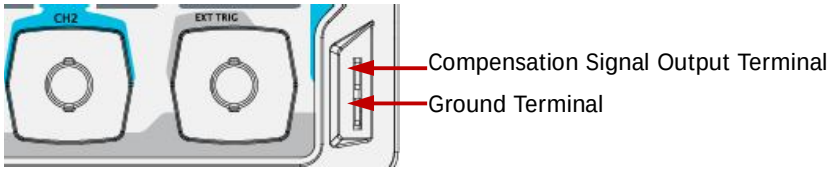


Figure 7 To Use the Compensation Signal

4. Press **AUTO**.
5. Observe the waveform on the display. In normal condition, the display should be a square waveform as shown in the figure below:

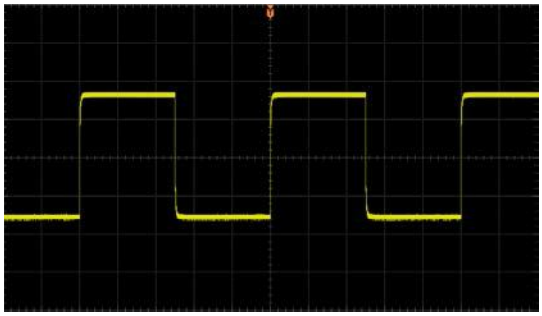


Figure 8 Square Waveform

6. Use the same method to test the other channels. If the square waveforms actually shown do not match that in the figure above, please perform “**Probe Compensation**”.

WARNING

To avoid electric shock during the use of probe, please make sure that the insulated wire of the probe is in good condition and do not touch the metallic part of the probe when the probe is connected to high voltage source.

Tip

The signal output from the probe compensation connector can only be used for probe compensation adjustment and can not be used for calibration.

Probe Compensation

When the probes are used for the first time, you should compensate the probes to match the input channels of the oscilloscope. Non-compensated or poorly compensated probes may cause measurement inaccuracy or error. The probe compensation procedures are as follows:

1. Perform steps 1, 2, 3 and 4 of **"Function Inspection"**.
2. Check the displayed waveforms and compare them with the following figures.

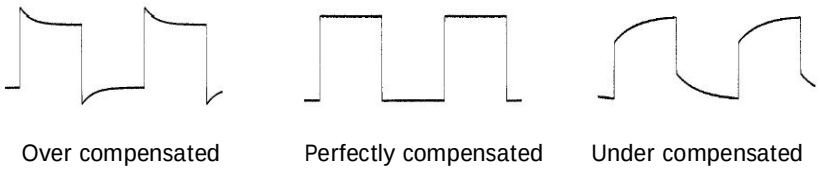


Figure 9 Probe Compensation

3. Use a nonmetallic driver to adjust the low-frequency compensation adjustment hole on the probe until the displayed waveform is as the "Perfectly compensated" in the figure above.

Front Panel Overview

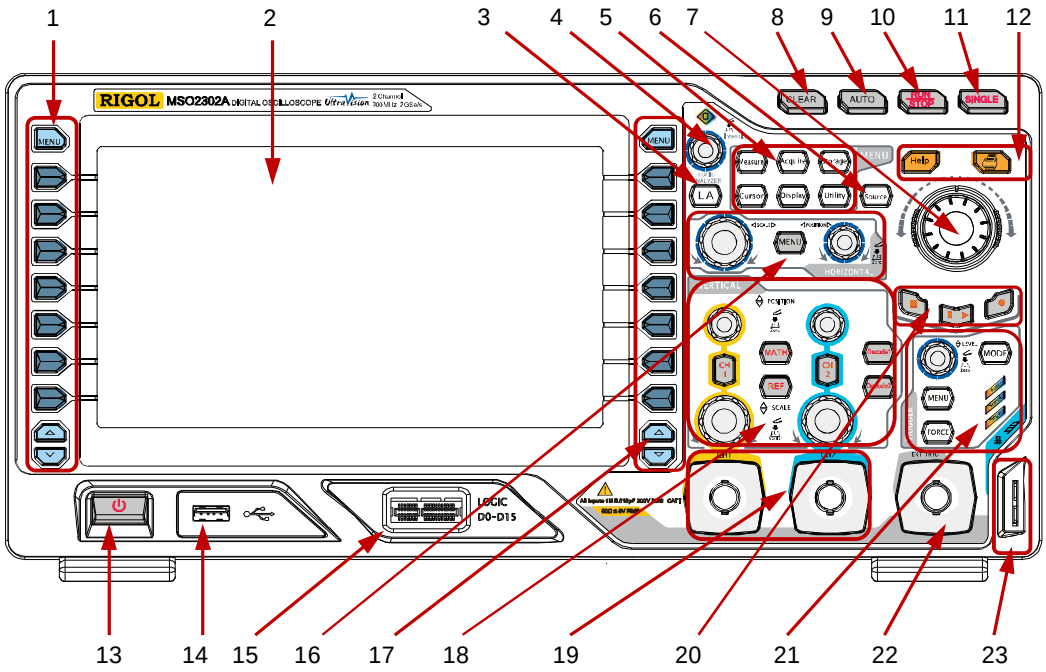


Figure 10 Front Panel Overview

Table 1 Front Panel Description

No.	Description	No.	Description
1	Measurement Menu Softkeys	13	Power Key
2	LCD	14	USB HOST Interface
3	Logic Analysis Control Key[1]	15	Digital Channel Input Interface[1]
4	Multifunction Knob	16	HORIZONTAL Control Area
5	Function Menu Keys	17	Function Menu Softkeys
6	Signal Source[2]	18	VERTICAL Control Area
7	Navigation Knob	19	Analog Channel Input Area
8	CLEAR	20	Waveform Record/Playback Control Keys
9	AUTO	21	TRIGGER Control Area
10	RUN/STOP	22	EXT TRIG Input Terminal
11	SINGLE	23	Probe Compensation Signal Output Terminal/ Ground Terminal
12	Help/Print	--	--

Note[1]: Only applicable to MSO2000A and MSO2000A-S models oscilloscopes.

Note[2]: Only applicable to MSO2000A-S and DS2000A-S models oscilloscopes.

Rear Panel Overview

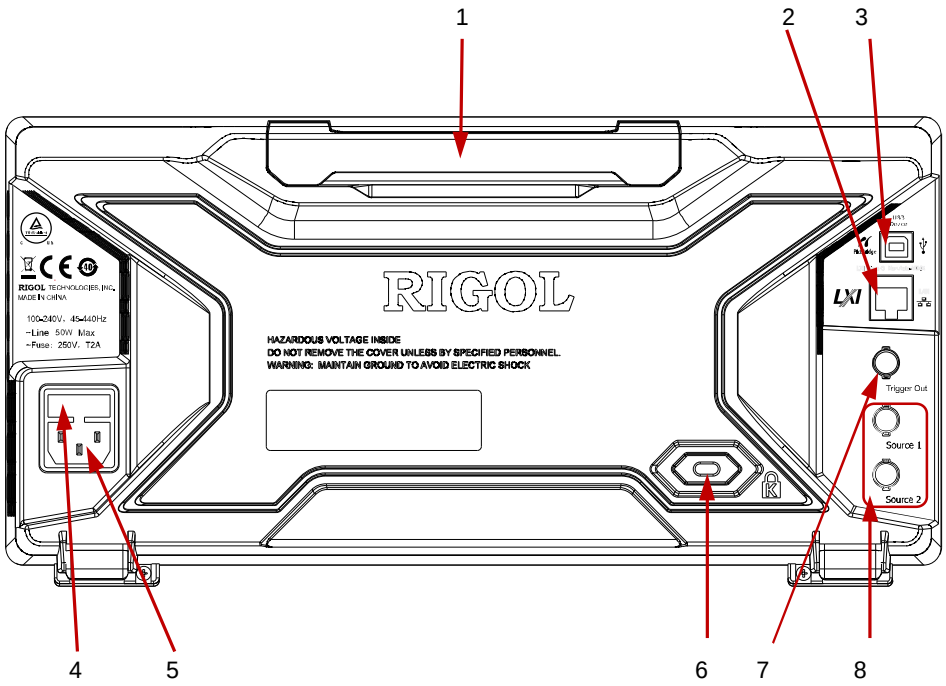


Figure 11 Rear Panel Overview

1. Handle

Pull up the handle vertically for easy carrying of the instrument. When you do not need the handle, press it down.

2. LAN

Connect the instrument to the network via this interface for remote control. This oscilloscope conforms to the LXI-C class instrument standards and can quickly build test system with other instruments.

3. USB DEVICE

PictBridge printer or PC can be connected via this interface to print waveform data or control the instrument using PC software.

4. Fuse

If a new fuse is required, please use the specified fuse (250V, T2A). The replacing method is as follows.

(1) Turn off the instrument and remove the power cord.
(2) Insert a small straight screwdriver into the slot at the power socket and pry out the fuse seat gently.
(3) Take out the fuse and replace it with a fuse of the specified specification. Then, reinstall the fuse seat.

5. AC Power Socket

AC power input terminal. The power requirement of this oscilloscope is 100-240 V, 45-440 Hz. Use the power cord provided with the accessories to connect the instrument to AC power. Then, you can press the power key at the front panel to start the instrument.

6. Lock Hole

You can lock the instrument to a fixed location using the security lock (please buy it yourself) via the lock hole.

7. Trigger Out

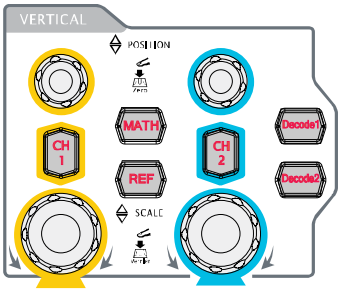
The oscilloscope can output a signal that can reflect the current capture rate of the oscilloscope at each trigger via this interface. Connect the signal to a waveform display device and measure the frequency of the signal. The measurement result is the same with the current capture rate. The instrument can also output a signal when failed waveform is detected during the pass/fail test.

8. Source Output

When Source1 or Source2 is enabled, the signal currently set can be output through the **[Source1]** or **[Source2]** connector at the rear panel to the analog input terminal of the oscilloscope or external devices connected to them. This function is only available for MSO2000A-S and DS2000A-S models oscilloscopes.

Front Panel Function Overview

VERTICAL



CH1, **CH2**: analog input channels. The 2 channels are marked by different colors which are also used to mark both the corresponding waveforms on the screen and the channel input connectors. Press any key to open the corresponding channel menu and press again to turn off the channel.

MATH: press this key to open the math operation menu under which add, subtract, multiply, divide, FFT, logic and advanced operations are provided.

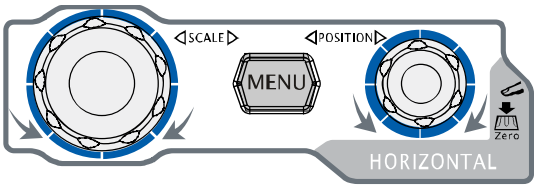
REF: press this key to enable the reference waveform function to compare the waveform actually tested with the reference waveform.

Vertical POSITION: modify the vertical position of the current channel waveform. Turn clockwise to increase the position and turn counterclockwise to decrease. During the modification, the waveform would move up and down and the position message (e.g. POS: 930.0mV) at the lower-left corner of the screen would change accordingly. Press down this knob to quickly reset the vertical position to zero.

VERTICAL SCALE: modify the vertical scale of the current channel. Turn clockwise to decrease the scale and turn counterclockwise to increase. During the modification, the display amplitude of the waveform would enlarge or reduce but the actual amplitude remains unchanged. The scale information (e.g. 1 500mV) at the lower side of the screen would change accordingly. Press down this knob to quickly switch the vertical scale adjustment modes between “Coarse” and “Fine”.

Decode1, **Decode2**: decoding function keys. Press the corresponding key to open the decoding function menu. MSO2000A/DS2000A support parallel decoding and protocol decodings.

HORIZONTAL

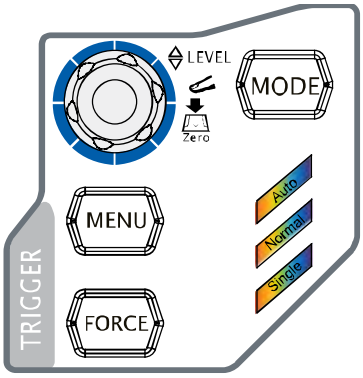


MENU: press this key to open the horizontal control menu under which to turn on or off the delayed sweep function, switch between different time base modes, switch between "Coarse" and "Fine" adjustment of scale as well as modify the horizontal reference setting.

HORIZONTAL SCALE: modify the horizontal time base. Turn clockwise to reduce the time base and turn counterclockwise to increase the time base. During the modification, waveforms of all the channels will be displayed in expanded or compressed mode and the time base message (e.g. H 5.000ns) at the upper side of the screen would change accordingly. Press down this knob to quickly switch to the delayed sweep state.

HORIZONTAL POSITION: modify the horizontal position. The trigger point would move left or right relative to the center of the screen when you turn the knob. During the modification, waveforms of all the channels would move left or right and the trigger position message (e.g. D 5.80000000ns) at the upper-right corner of the screen would change accordingly. Press down this knob to quickly reset the trigger position (or the delayed sweep position).

TRIGGER



MODE: press this key to switch the trigger mode to **Auto**, **Normal** or **Single** and the corresponding state backlight of the current trigger mode would be illuminated.

TRIGGER **LEVEL**: modify the trigger level. Turn clockwise to increase the level and turn counterclockwise to reduce the level. During the modification, the trigger level line would move up and down and the value in the trigger level message box (e.g.

) at the lower-left corner of the screen would change accordingly. Press down the knob to quickly reset the trigger level to zero point.

MENU: press this key to open the trigger operation menu. This oscilloscope provides various trigger types.

FORCE: in **Normal** and **Single** trigger modes, press this key to generate a trigger signal forcefully.

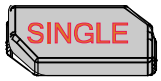
CLEAR

Press this key to clear all the waveforms on the screen. If the oscilloscope is in the "RUN" state (the key is illuminated in yellow), new waveforms will still be displayed.

RUN/STOP

Press this key to set the state of the oscilloscope to "RUN" or "STOP".
In the "RUN" state, the key is illuminated in yellow.
In the "STOP" state, the key is illuminated in red.

SINGLE



Press this key to set the trigger mode to "Single", the key is illuminated in orange. In single trigger mode, press **FORCE** to generate a trigger signal immediately.

AUTO

Press this key to enable the waveform auto setting function. The oscilloscope will automatically adjust the vertical scale, horizontal time base and trigger mode according to the input signal to realize optimum waveform display. **Note:** auto setting requires that the frequency of the signal under test should be no lower than 25 Hz. If the parameter exceed the limit, "Can't detect any signal!" would be displayed after pressing this key and the quick parameter measurement menu might not be displayed.

Knob

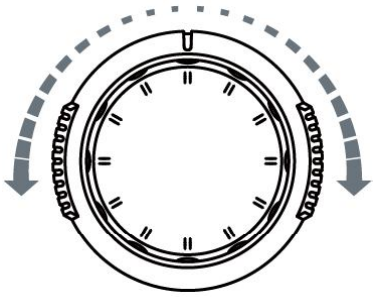
Adjust waveform brightness:

In non-menu-operation mode (menu is hidden), turn this knob to adjust the brightness of waveform display. The adjustable range is from 0% to 100%. Turn clockwise to increase the brightness and counterclockwise to reduce. Press down this knob to reset the brightness to 50%. You can also press **Display** → **WaveIntensity** and use the knob to adjust the waveform brightness.

Multifunction (the backlight goes on during operation):

In menu operation, press any menu softkey and turn the knob to select the submenus under this menu and then press down the knob to select the current submenu. It can also be used to modify parameters and input filename. In addition, for MSO2000A-S and DS2000A-S models oscilloscopes, in the source interface, press the corresponding menu softkey and then press the knob; the numeric keyboard will pop-up on the screen and you can input the desired parameter value and unit directly using this knob.

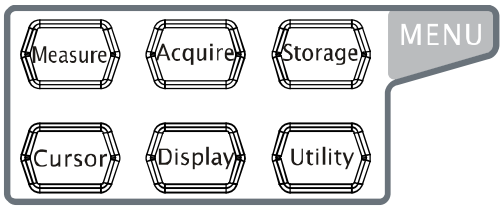
Navigation Knob



This knob provides quick Adjust/Locate function for numerical parameters with relatively large settable range. Turn clockwise (counterclockwise) to increase (reduce) the value. The inner knob is used for fine adjustment and the outer knob for coarse adjustment.

For example, this knob can be used to quickly locate the waveform frame (“Current Frame” menu) to be played back in the waveform playback function. Similar menus include trigger holdoff, pulse width setting, slope time etc.

MENU



Measure: press this key to open the measurement setting menu. You can set the measurement setting, all measure, statistic function etc. Press **MENU** at the left of the screen to open the measurement menus of 24 waveform parameters. Then, press down the corresponding menu softkey to quickly realize one-key measurement and the measurement result will be displayed at the bottom of the screen.

Acquire: press this key to enter the sample setting menu to set the acquisition mode, memory depth and antialiasing function of the oscilloscope.

Storage: press this key to enter the file store and recall interface. The storable file types include traces, waveforms, setups, picture and CSV. The picture can be stored in bmp, png, jpeg and tiff formats. Internal and external storage as well as disk management are also supported.

Cursor: press this key to enter the cursor measurement menu. The oscilloscope provides four cursor modes: manual, track, auto and X-Y. **Note:** X-Y cursor mode is only available for the X-Y time base mode.

Display: press this key to enter the display setting menu to set the display type, persistence time, wave intensity, grid type, grid brightness and menu display time of the waveform.

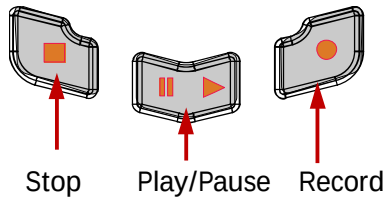
Utility: press this key to enter the system utility function setting menu to set the system-related functions or parameters, such as the I/O, sound and language. Besides, some advanced functions (such as the pass/fail test, waveform record and print setting) are also supported.

Signal Source

Press this key to enter the source setting interface. You can enable or disable the output of the **[Source1]** or **[Source2]** connector at the rear panel, set the output signal parameters (such as the frequency, amplitude, offset and phase).

Note: This function is only available for MSO2000A-S and DS2000A-S models oscilloscopes.

Record



Record: press this key to start recording the waveform. At this moment, the red backlight of the key will start flashing. Besides, when the record constant on (Open) is enabled, the backlight will also keep flashing.

Play/Pause: in the stop or pause state, press this key to play back the waveform and press again to pause the play. The backlight is illuminated in yellow.

Stop: press this key to stop the waveform being recorded or being played back. The backlight is illuminated in orange.

Print

Press this key to execute the print function or save the screen in the USB storage device. If a PictBridge printer is currently connected and the printer is in idle state, pressing this key will execute the print function. If no printer but a USB storage device is currently connected, pressing this key will save the screen to the USB storage device in ".png" format by default. You can also save the screen in the specified picture format (bmp, png, jpeg and tiff) by pressing the **Storage** to set the storage type as picture, and then pressing the **Pic Type** to select the desired format. When printer and USB storage device are connected at the same time, the printer enjoys higher priority.

Logic Analyzer

Press this key to open the logic analyzer control menu. You can turn on or off any channel or channel group, modify the display size of the digital channel, modify the logic threshold of the digital channel as well as group the 16 digital channels and display them as a bus. You can also set a label for each digital channel.

Note: This function is only applicable to the MSO2000A and MSO2000A-S models oscilloscopes.

User Interface

MSO2000A/DS2000A provides 8.0 inch, WVGA (800*480) 160,000 color TFT LCD. What is worth mentioning is that the 14-grid ultra-wide screen enables you to view "longer" waveform.

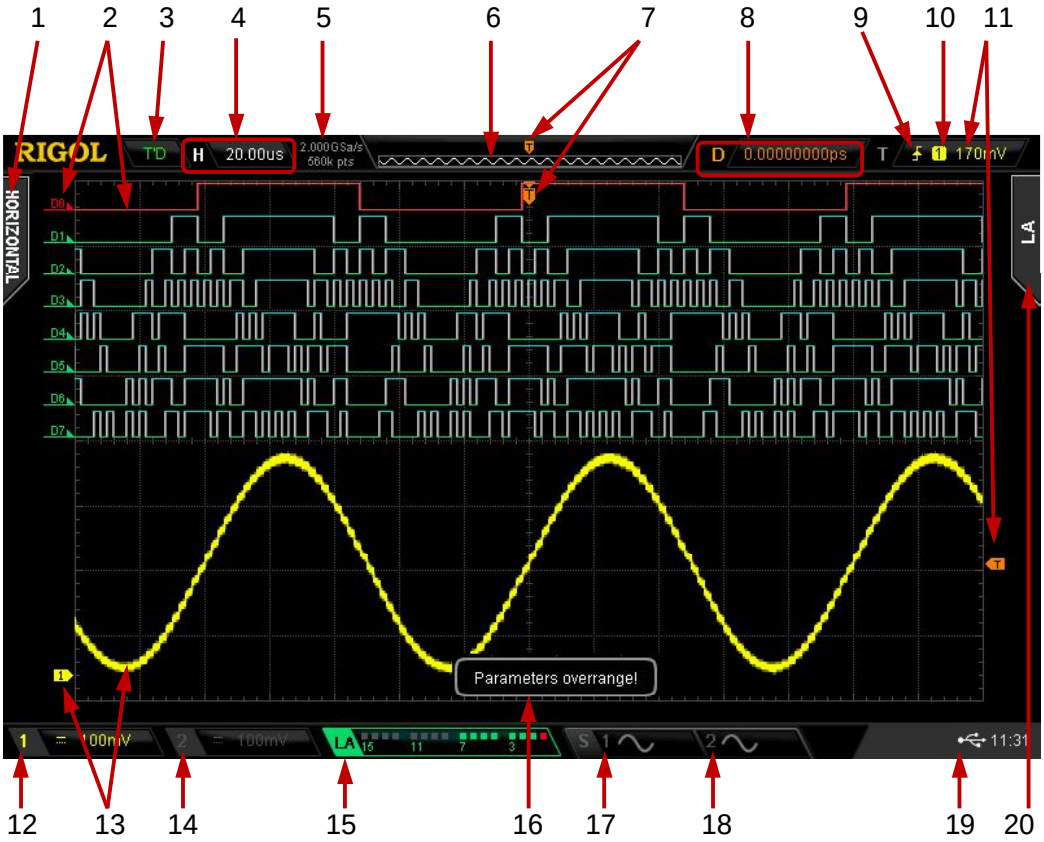


Figure 12 User Interface

1. Auto Measurement Items

Provide 12 horizontal (HORIZONTAL) and 12 vertical (VERTICAL) measurement parameters. Press the softkey at the left of the screen to activate the corresponding measurement item. Press **MENU** continuously to switch between the horizontal and vertical parameters.

2. Digital Channel Label / Waveform

The logic high level of the digital waveform is displayed in blue and the logic low level in green (correspond to the color of the channel label). Its edge is displayed in white. The label and waveform of the digital channel currently selected are displayed in red. **Note:** This function is only applicable to MSO2000A and MSO2000A-S models oscilloscopes.

3. Status

Available states include RUN, STOP, T'D (triggered), WAIT and AUTO.

4. Horizontal Time Base

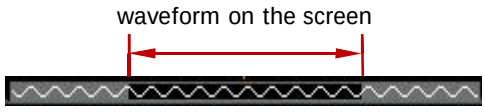
- Represent the time per grid on the horizontal axis on the screen.
- Use **HORIZONTAL** **SCALE** to modify this parameter. The range available is from 1.000 ns to 1.000 ks (for 200 MHz bandwidth oscilloscope, the range available is 2.000 ns to 1.000 ks; for 100 MHz and 70 MHz bandwidth oscilloscope, the range available is 5.000 ns to 1.000 ks).

5. Sample Rate / Memory Depth

- Display the current sample rate and memory depth of the oscilloscope.
- Use **HORIZONTAL** **SCALE** to modify this parameter.

6. Waveform Memory

Provide the schematic diagram of the memory position of the waveform currently on the screen.



7. Trigger Position

Display the trigger position of the waveform in the waveform memory and on the screen.

8. Horizontal Position

Use **HORIZONTAL** **POSITION** to modify this parameter. Press down the knob to automatically set the parameter to zero.

9. Trigger Type

Display the currently selected trigger type and trigger condition setting. Different labels are displayed when different trigger types are selected.

For example: represents triggering on the rising edge in "Edge" trigger.

10. Trigger Source

Display the trigger source currently selected (CH1, CH2, EXT, EXT/5, AC Line or D0-D15). Different labels are displayed when different trigger sources are selected and the color of the trigger parameter area will change accordingly.

For example: denotes that CH1 is selected as the trigger source. **Note:** EXT/5 is only applicable to MSO2000A and MSO2000A-S models oscilloscopes.

11. Trigger Level

- When the trigger source is set to CH1 or CH2, the trigger level label is displayed at the right of the screen and the trigger level value is displayed at the upper-right corner of the screen. When using **TRIGGER** **LEVEL** to modify the trigger level, the trigger level value will change with the up and down of .
- When the trigger source is set to EXT or EXT/5, the trigger level value is displayed at the upper-right corner of the screen. No trigger level label is displayed.
- When the trigger source is set to AC Line, no trigger level value and trigger level label is displayed.
- When the trigger source is set to D0 to D15, the trigger threshold is displayed at the upper-right corner of the screen. No trigger level label is displayed.
- In Runt trigger, Slope trigger and Windows trigger, two trigger level labels (and) are displayed.

12. CH1 Vertical Scale

- Display the voltage value per grid of CH1 waveform vertically.
- Use **VIRTICAL** **SCALE** of CH1 to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.), input impedance (e.g.) and bandwidth limit (e.g.).

13. Analog Channel Label / Waveform

Different channels are marked with different colors and the colors of the channel label and waveform are the same.

14. CH2 Vertical Scale

- Display the voltage value per grid of CH2 waveform vertically.
- Use **VIRTICAL** **SCALE** of CH2 to modify this parameter.
- The following labels will be displayed according to the current channel setting: channel coupling (e.g.), input impedance (e.g.) and bandwidth limit (e.g.).

15. Digital Channel Status Area

Display the current status of the 16 digital channels (D0 to D15 from right to left). The digital channels currently turned on are displayed in green and the digital channel currently selected is displayed in red. The digital channels turned off are displayed in grey in the digital channel area. **Note:** This function is only applicable to MSO2000A and MSO2000A-S models oscilloscopes.

16. Message Box

Display the prompt messages.

17. Source1 Waveform

- Display the type of waveform currently set for Source1.
- When the impedance of source 1 is set to 50 Ω, will be displayed at the right of the Source1 waveform.
- When the modulation of source 1 is enabled, will be displayed at the right of the Source1 waveform.
- Only available for MSO2000A-S and DS2000A-S models oscilloscopes.

18. Source2 Waveform

- Display the type of waveform currently set for Source2.
- When the impedance of source 2 is set to 50 Ω, will be displayed at the right of the Source2 waveform.
- When the modulation of source 2 is enabled, will be displayed at the right of the Source2 waveform.
- Only available for MSO2000A-S and DS2000A-S models oscilloscopes.

19. Notification Area

Display the system time, sound icon and USB storage device icon.

- System Time: displayed in "hh:mm (hour:minute)" format. When printing or storing the waveform, the output file will contain this time message. Press **Utility** → **System** → **System Time** → **System Time** to set through the following format:
  yyyy-mm-dd hh:mm:ss (year-month-date hour:minute:second)
- Sound Icon: when the sound is enabled, will be displayed. Press **Utility** → **Sound** to enable or disable the sound.
- USB Storage Device Icon: when a USB storage device is detected, will be displayed.

20. Operation MENU

Press any softkey to activate the corresponding menu. The following symbols might be displayed in the menu:

Denote that at the front panel can be used to select the parameter items. The backlight of turns on when the parameter selection is valid.

Denote that can be used to modify the parameter values. The backlight of turns on when the parameter input is valid.

Denote that can be used to modify the parameter values and press to input the desired paramrter values directly using the pop-up numeric keyboard. The backlight of turns on when the parameter input is valid.

Denote that you can use the "**Navigation Knob**" to quickly adjust/locate parameters.

Denote that you can use to adjust the parameter and then press down to select the parameter. The backlight of is constant on.

Denote that the current menu has several options.

Denote that the current menu has a lower level menu.

Press this key to return to the previous menu.

Note: The following direction keys might appear in the grid at the lower-left corner of the menu bar:

Denote that you can open the next page menu.

Denote that you can open the previous page menu.

To Use the Security Lock

If needed, you can use the security lock (please buy it yourself) to lock the oscilloscope to a fixed location. The method is as follows, align the lock with the lock hole and plug it into the lock hole vertically, turn the key clockwise to lock the oscilloscope and then pull the key out.

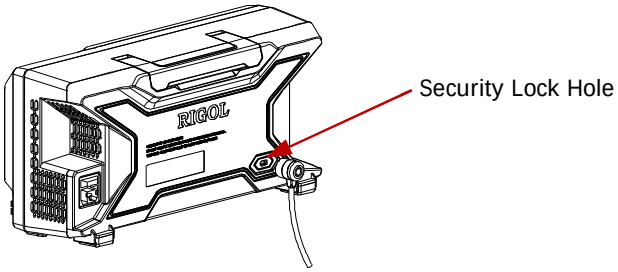


Figure 13 To Use the Security Lock

Note: Please do not insert other articles into the security lock hole to avoid damaging the instrument.

To Use the Built-in Help System

The help system of this oscilloscope provides instructions for all the function keys (including the menu keys) at the front panel. Press **Help** to open the help interface and press again to close the interface. The help interface mainly consists of two parts. The left is "Help Options" and you can use "Button" or "Index" mode to select. The right is "Help Display Area".

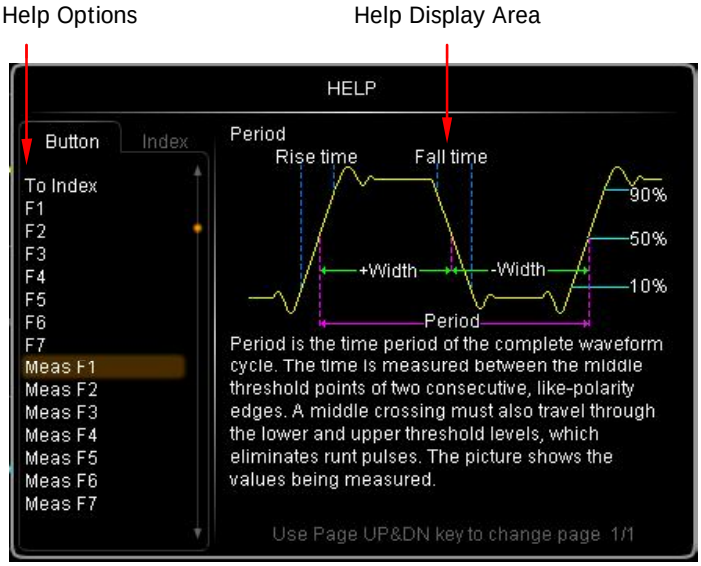


Figure 14 Help Information

Button:

Default mode. In this mode, you can press the button (except the power key and the function menu page up/down key at the right of the screen) or rotate the multifunction knob at the front panel to select the button name to get the corresponding help information in the "Help Display Area". In addition, you can get the help information of the navigation knob by rotating the navigation knob directly or using to select "WaveFunder". Rotate to select "To Index" and then press the knob to switch to **Index** mode.

Index:

In this mode, use to select the item that needs to get help (for example, "BW"). The item currently selected is displayed in brown. Press the knob to get the corresponding help information in the "Help Display Area". Use to select "To Button" and then press the knob to switch to **Button** mode.

Troubleshooting

The commonly encountered failures and their solutions are listed below. When you encounter those failures, please solve them following the corresponding steps. If the problem remains still, please contact **RIGOL** and provide your device information (acquisition method: **Utility** → **System** → **System Info**).

1. **The screen is still dark (no display) after power on:**
   (1) Check whether the power switch is turned on.
   (2) Check whether the power is correctly connected.
   (3) Check whether the fuse is burned out. If the fuse needs to be changed, please use the specified fuse.
   (4) Restart the instrument after finishing the above inspections.
   (5) If it still does not work correctly, please contact **RIGOL**.

2. **The signal is sampled but no waveform of the signal is displayed:**
   (1) Check whether the probe is correctly connected to the item under tested.
   (2) Check whether there are signals generated from the item under test (you can connect the probe compensation signal to the problematic channel to determine which has problem, the channel or the item under test).
   (3) Resample the signal.

3. **The voltage amplitude measured is greater or lower than the actual value (note that this failure usually only occurs when probe is used):**
   Check whether the attenuation ratio of the channel complies with the attenuation ratio of the probe.

4. **There is waveform display but not stable:**
   (1) Check the trigger signal source: press **MENU** of the TRIGGER Control Area of the front panel, then press **Source** to confirm whether the setting complies with the signal channel actually used.
   (2) Check the trigger type: general signals should use “Edge” trigger and video signal should use “Video” trigger. Only when the proper trigger type is used, can the waveform be displayed stably.
   (3) Check the trigger level: adjust the trigger level to the middle of the signal.
   (4) Change the trigger holdoff setting.

5. No display after pressing RUN/STOP:

Check the TRIGGER Control Area of the front panel to confirm whether the trigger mode is "Normal" or "Single" and whether the trigger level exceeds the waveform range. If yes, set the trigger level to the middle or press the **MODE** to set the trigger mode to "Auto".

Note: Using **AUTO** could automatically finish the above setting.

6. The display of waveform is ladder-like:

(1) The horizontal time base might be too low. Increase the horizontal time base to increase the horizontal resolution and improve the display.

(2) If the display **Type** is "Vectors", the lines between the sample points may cause ladder-like display. Press **Display** → **Type** , set the display type to "Dots" to solve the problem.

7. Fail to connect PC or PictBridge through USB:

(1) Press **Utility** → **IO Setting** → **USB Device** to check whether the setting matches the device currently connected.

(2) Check whether the USB cable is correctly connected to the instrument and PC.

(3) Check whether the USB cable is in good condition. If needed, restart the oscilloscope.

8. The USB storage device cannot be recognized:

(1) Check whether the USB storage device can work normally.

(2) Check whether the USB storage device being used is flash type. This oscilloscope does not support hardware type USB storage device.

(3) Check whether the capacity of the USB storage device is too large. It is recommended that the capacity of the USB storage device being used with this oscilloscope is no larger than 8 GBytes.

(4) Restart the instrument and then insert the USB storage device to check it.

(5) If the USB storage device still cannot be used normally, please contact **RIGOL**.